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A Review on Phyto-Pharmacological Aspects of Apamarg (*Achyranthes aspera Linn.)*

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Abstract

Achyranthes aspera is very important ayurvedic medicinal plant. It is known as Apamarg Sanskrit name, prickly chaff flower in English and Naayuruvi in Tamil. It belongs to the family Amaranthaceae. This medicinal plant found as a weed thrrought India up to 900 m. Though almost all of its parts are used in traditional system of medicines, seeds, roots, and shoots are the most important parts, which are used medicinally. The major phytoconstituents are carbohydrate, protein, glycosides, alkaloids, tannins, flavonoids, and lignin. It also contains the phytochemicals like oleanolic acid, Saponin A and saponin B. A large number of phytochemical constituents have been isolated from the plant which possesses several pharmacological activities like diuretic, purgative, laxative, antiasthmatic, hepatoprotective, anti-allergic, hepatitis, renal disorders, dermatological disorders, gynecological disorders, gonorrhea, malaria, fever, cough, diabetes. The juice of the plant is used in the treatment of boils, diarrhea, dysentery, hemorrhoids, rheumatic pains, itches and skin eruption.

Keywords: *Achyranthes aspera, Phytoconstituents, Pharmacology*

1. Introduction

There exists a plethora of knowledge and information and benefits of herbal drugs in our ancient literature of Ayurvedic and Unani medicine. One of the earliest treatises of Indian medicine, the Charaka Samhita (1000 B.C.) mentions the use of over 2000 herbs for medicinal purpose [1]. A medicinal plant is factually any plant which in one or more of its parts contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of direct therapeutic agents. Approximately 25% of drugs in modern pharmacopoeia were derived from plants and many others were synthetic analogues built on prototype compounds isolated from plants [2]. Plants have unlimited ability to synthesize secondary metabolites such as tannins, terpenoids, alkaloids, glycosides and phenols which possess antimicrobial properties. It has been estimated that 14-28% of higher plant species are used in medicinal purposes and that 74% of pharmacologically active plant derived components were discovered after following ethnobotanical uses of the plants [3, 4]. World Health Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species and more than 80 % of the world's population relies on traditional herbal medicine for their primary health care [5, 6]. Indian folk medicine comprises of numerous prescriptions for therapeutic purposes such as healing of wounds, inflammation, skin infections, leprosy, diarrhea, scabies, venereal disease, ulcers, snake bite, etc[7]

Apamarga (Achyranthes aspera Linn) Family: Amaranthaceae is an erect stiff, annual-perennial herb, often will woody base, occurs naturally throughout India. Plant is found common in waste places roadsides, hedges, gardens, fields or farms, fore edges, forest clearings and other places. It is commonly known as Chaff Tree, Prickly- chaff Flower, Rough-chaff Tree [8].

Taxonomy, Morphology and Distribution:

Kingdom-Plantae
Division-Magnoliophyta
Class- Magnoliopsida

Subclass-Caryophyllidae
Order-Caryophyllales
Family-Amaranthaceae
Genus-*Achyranthes*
Species-*aspera*

Synonyms:

Unani-Chirchitaa
French-Collant
Bengali-Apang, uputhlengra
Assam-Apang
Hindi-Latjira, Chirchira, Chirchita
Sanskrit-Apmarga, Aghata
English-Prickly Chaff flower, Rough chaff tree, Red chaff tree
Gujarati-Safad Aghedo
Tamil-Shiru – Kadaladi
Telgu-Uttaraene
Punjabi-Kurti
Malyalam-Kadaladi[9]

Fig.1.

Achyranthes aspera Linn is a stiff erect annual herb (fig. 1).

Habit: A wild, perennial, erect herb.

Stem: Herbaceous but woody below, erect, branched, cylindrical, solid, angular, hairy, longitudinally striated, nodes and internodes are prominent, green but violet or pink at nodes.

Leaves: Ramal and cauline, simple, exstipulate, opposite decussate, petiolate, ovate or obovate, entire, acute or acuminate, hairy all over, unicostate reticulate.

Inflorescence: A spike with reflexed flowers arranged on long peduncle.

Flowers: Bracteate, bracteolate, bracteoles two, shorter than perianth, dry, membranous and persistent, sessile, complete, hermaphrodite, actinomorphic, pentamerous, hypogynous, small, spinescent, green. Bracts, ovate, persistent, awned. Perianth made up of 5 tepals, polyphyllous, imbricate or quincuncial, green, ovate to oblong, persistent.

Androecium made up of 10 stamens, out of which 5 are fertile and 5 are scale-like, fimbriated, sterile staminodes, both alternating with each other, fertile stamens are antiphyllous, monadelphous, filaments slightly fused at the base, dithecous, dorsifixed or versatile, introrse.

Gynoecium: it is bicarpellary, syncarpous, superior, unilocular, ovule one, basal placentation, style single and filiform, stigma capitate.

Fruits: Oblong utricle

Seeds: Endospermic with curved embryo, 2 mm long, oblong black [10].

Achyranthes aspera is widespread through the tropics and subtropics of Europe, Africa, Asia, Australia and the Americas. It is thought to have originated from the Old Word. It occurs in open dry places at elevations up to 2000-3000 m (Nepal or Tanzania). It is often found in secondary regrowth at forest edges, in thickets, open grassland, along forest trails, in sand dunes and in seasonal swamps and dried-up watercourses. It grows in sandy soils, especially in the shade of trees and bushes. It is considered a weed in Mexico where it grows in disturbed areas. It has been reported to be invasive in some areas of Tanzania. In East Java, *Achyranthes aspera* is one of the predominant species of the understory of *Acacia nilotica* [11-13].

Physico-Chemical Studies

Determination of Total ash value

2 gram of sample was accurately weighed in a tarred silica crucible at temperature 450 oC until it was free from carbon. Then it was cooled and weighed. The percentage of total ash was calculated with reference to the air- dried drug.

Determination of Acid insoluble ash

The total ash obtained was boiled for 5 minutes with 25 ml of dilute hydrochloric acid; the insoluble matter obtained was collected on an ash less filter paper, washed with hot water and ignited to constant weight. The percentage of acid-insoluble ash was calculated with reference to the air dried drug.

Water-soluble Ash

The ash obtained in the determination of total ash was boiled for 5 minutes with 25 ml of water. The insoluble matter was collected on an ash less filter paper and washed with hot water. The insoluble ash was transferred into a tarred silica crucible and ignited for 15 minutes at temperature 450oC. The weight of the insoluble matter was subtracted from the weight of the total ash. The difference in weight was considered as the water- soluble ash was calculated with reference to the air-dried drug.

Determination of hydro-alcoholic extractive value

Hydro-alcoholic extract of air dried 100 gm coarse powder of the sample was extracted with Ethanol: Distilled water (50:50), 450 ml each, with continuous heat extraction with Soxhlet apparatus and filtered. The extract was concentrated to get dry residue and stored in the desiccators and after that the percentage of hydro-alcoholic extract was calculated with reference to the air dried drug.

Determination of loss on drying

10 g of the sample (without preliminary drying) was weighed and placed in a tarred evaporating dish. It was dried at 105˚C for 5 hours and at 1 hour interval until difference two successive weightings

Determination of pH

The powder of sample was weighed to about 5g and immersed in 100 ml of water in a beaker. The beaker was closed with aluminum foil and left behind for 24 hours at room temperature. Later the supernatant solution was decanted into another beaker and the pH of the formulation was determined using a calibrated pH meter[14]

Qulitative Phytochemical Screening [15]

The preliminary phytochemical studies were performed for testing the different chemical groups present in the drug. 10% (w/v) solution of extract was taken unless otherwise mentioned in the respective individual test. General screening of various extracts of the plant material was carried out for qualitative determination of the groups of organic compounds present in them.

Alkaloids

- **Dragendorff's test**: Dissolve a few mg of hydro-alcoholic extract until an acid reaction occurs, and then add 1 ml of Dragendorff's reagent, an orange or orange-red precipitate is produced immediately.
- **Hager's test:** 1 ml of Hydroalcoholic extract of the drug was taken in a test tube, adding a few drops of Hager's reagent. Formation of yellow precipitate confirms the presence of alkaloids.
- **Wagner's test**: Acidifying 1 ml of hydro-alcoholic extract of the drug with 1.5% w/v of hydrochloric acid and adding a few drops of Wagner's reagent. A yellow or brown precipitate is formed.

- **Mayer's test**: Adding a few drops of Mayer's reagent to 1 ml of hydro-alcoholic extract of the drug. White or pale-yellow precipitate is formed.

Carbohydrates

- **Anthrone test:** Take 2 ml of Anthrone test solution, adding 0.5 ml of hydro-alcoholic extract of the drug. A green or blue colour indicates the presence of carbohydrates.
- **Benedict's test:** Take 0.5 ml of hydro-alcoholic extract of the drug adding 5 ml of Benedict's solution and boiling for 5 minutes. Formation of a brick red colour precipitate is due to the presence of carbohydrates.
- **Fehling's test:** Take 2 ml of hydro-alcoholic extract of the drug adding 1 ml of a mixture of equal parts of Fehling's solution 'A' and Fehling's solution 'B' and boiling the contents of the test tube for few minutes. A red or brick red precipitate is formed.
- **Molisch's test:** In a test tube containing 2 ml of hydro-alcoholic extract of the drug adding 2 drops of a freshly prepared 20% alcoholic solution of β- naphthol and mix, pouring 2 ml conc. sulphuric acid so as to from a layer below the mixture. Carbohydrates, if present, produce a red-violet ring, which disappears on the addition of an excess of alkali solution.

Flavonoids

- **Shinoda's test**: In a test tube containing 0.5 ml of hydro-alcoholic extract of the drug, adding 5-10 drops of dil. hydrochloric acid followed by a small piece of magnesium. In the presence of flavonoids, a pink, reddish pink or brown colour is produced.
- **Saponins** In a test tube containing about 5 ml of hydro-alcoholic extract of the drug adding a drop of sodium bicarbonate solution, shaking the mixture vigorously and leave for 3 minutes. Honeycomb like froth is formed.

Steroids

- **Liebermann-Burchard's test:** Adding 2 ml of acetic anhydride solution to 1 ml of hydro-alcoholic extract of the drug in chloroform followed by 1 ml of conc. sulphuric acid. A greenish colour is developed which turns to blue.
- **Salkowski Reaction:** Adding 1 ml of conc. sulphuric acid to 2 ml of hydro-alcoholic extract of the drug carefully from the side of the test tube. A red colour is produced in the chloroform layer.

Tannins

- To 1–2 ml of plant hydro-alcoholic extract, adding a few drops of 5% FeCl3 solution was added. A green colour indicates the presence of gallo-tannins while brown colour tannins.

Glycosides

- Detection of glycoside on paper spray solution No. 1 (0.5% aqueous sol. of Sodium metaperiodate) & waiting for 10 minutes after then spraying solution No. 2 [0.5% Benzidine (w/v) in solution of Ethanol–acetic Acid (4:1)], white spot with blue background shows presence of glycoside.

Proteins

- **Biuret's test**: To 1 ml of hot hydro-alcoholic of the drug adding 5-8 drops of 10% w/v sodium hydroxide solution followed by 1 or 2 drops of 3% w/v copper sulphate solution. A red or violet colour is obtained.
- **Millon's test**: Dissolving a small quantity of hydro-alcoholic of the drug in 1 ml of distilled water and adding 5-6 drops of Millon's reagent. A white precipitate is formed which turns red on heating.

Table 1: Certificate of analysis of seeds of *Achyranthes aspera* L.

Parameters	Observation
Nature	*Coarse powder*
Colour	Brown
LOD	5.30%

Total ash value	8.25 (% w/w)
Acid insoluble ash	3.0 (% w/w)
pH	7.5

Table 3: Phytochemical screening of hydro-alcholic extract of seeds of *Achyranthes aspera* L.

Chemical Tests	Hydroalcoholic- Extract
Carbohydrates	-
Proteins	-
Amino acids	-
Glycosides	-
Flavanoids	+
Alkaloids	+
Tannins	+
Steroids	-
Phenolic Compounds	+
Coumarin	+
Saponin	+
Resin	+

Phytochemical- Constituents

Achyranthes aspera plant (whole herb) and seeds contain alkaline Substance specially potash. Chemical constituents of various parts of the plant has been isolated and identified.

LEAVES: isolated chemical compounds of the volatile oil from *Achyranthes aspera* leaves. Hydroquinone (57.7%) is the chief constituent; others are p-benzoquinone, spathulenol, nerol, α-ionone, asarone and eugenol. Alkaloids, flavonoids, saponins, tannins and phenolic compounds are found in the leaves [16-17].

STEM: Dihydroxy ketones-36, 37-dihydroxyhenpentacontan-4-one, and Triacontanol, aliphatic alcohol, 17-pentatriacontanol, penta-triaontane, 6-pentatriacontanone, Hexatriacontane, Tritriacontane, tetracontanol-2 (C40H82O), 4-methoxyheptatriacont-1-en-10-ol (C33H76O), E-sitosterol and spinasterol are isolated from the shoots of the plant. Triacontanol was also isolated along with 36, 47-dihydroxyhenpentacontan-4-one 21. Two long chain compounds, isolated from the shoots, have been characterized as 27-cyclohexylheptacosan-7-ol and 16-hydroxy-26-methyleheptacosan- 2-one 28. Kunert *et al*, 200029 has reported three bisdesmosidic saponins (I-III), 20-hydroxyecdysone and quercetin-3-O-β-D galactoside in the methanol extract [18-22].

Whole Plant: Mandar *et al*, 201119 showed the ethanol extract of whole plant on various Hematological (i.e. RBC, WBC count, Hb%, clotting time, O2 carrying capacity) and biochemical parameters (i.e. blood sugar level, lipid profile) in alloxan induced diabetic rats and concluded that *Achyranthes aspera* has haematinic, hypoglycemic and antihyperlipidemic activity which can complement in treatment of diabetic complications 19. Ethyl acetate extracts of whole plant (dried leaf, flower and seed extract) showed antiparasitic activity against the larvae of cattle tick *Rhipicephalus microplus*, sheep internal parasite *Paramphistomum cervi* [23].

Seed: Ethanol and chloroform extracts of seeds of *Achyranthes aspera* shows mild to moderate antibiotic activity against *B. subtilis*, *E. coli* and *P. aeruginosa* 88. Achyranthine, a water-soluble alkaloid isolated from *Achyranthes aspera*, decreased blood pressure and heart rate, dilated blood vessels, it also possess antipyretic activity and anti-inflammatory activity. Oleanolic acid present in *A. aspera, A. bidentata* extract can promote neuronal growth, protect hippocampal neurons against toxicity, and also has anti-stress and anti-apoptosis activities [24-27].

The growth-stimulating component of *Achyranthes aspera* seed is ecdysterone, whereas immune stimulating effect is primarily due to essential fatty acids (EFAs). The immune stimulation is higher when EFAs (linolenic acid and oleic acid) [28] are given in combination with other constituents of the seed.

Pharmacological Activities

Anti-hyperlipidemic activity

The alcoholic extract of the plant A. aspera at 100mg/kg dose lowered total serum cholesterol (TC) and phospholipid (PL), triglyceride (TG) and total lipids (TL) levels by 60, 51, 33 and

53 percent, respectively in triton-induced hyperlipidemic rats. The chronic administration of the extract at the same doses to normal rats for 30 days, lowered serum TC, PL, TG, and TL by 56,62,68 and 67 %, respectively followed by significant reduction in the levels of hepatic lipids. The possible mechanism of action of cholesterol lowering activity of the plant might be due to rapid excretion of bile acids causing low absorption of cholesterol [29].

Anti-diabetic activity

Aqueous and methanol extracts of the powdered whole plant of A. aspera, showed hypoglyceamic activity. Blood glucose levels of normal and Alloxan induced diabetic rabbits were determined after oral administration of various doses 30. The ethanol extract of A. aspera seed exhibited significant hypoglycemic activity in streptozotocin induced diabetic rats [31].

Akhtar et al., (1991) [30] reported the aqueous and methanol extracts of the powdered whole plant of A. aspera shown hypoglycemic activity. Blood glucose levels of normal and Alloxan induced diabetic rabbits were determined after oral administration of various doses.

Hepatoprotective activity

A.R. Bafna & S.H. Mishra (2004) reported that the methanolic extract of the aerial parts of *Achyranthes aspera* shows hepatoprotective activity on rifampicin induced hepatotoxicity in albino rats. Methanolic extract showed dose dependent decrease in the levels of SGPT, SGOT, ALKP and total bilirubin [32].

Anti-inflammatory activity

Anti-inflammatory activity of *A. aspera* has been reported [39]. Alcoholic plant extract was found to be the most active in most of the Wistar rats using carrageenan induced paw edema method and cotton pellet granuloma test reported [40]. The alcoholic extracts of leaves and seeds show anti-inflammatory activity in rats using induced paw edema method and formalin model [33]. The alcohol extract of *Achyranthes aspera* was tested on carrageenin-induced hind paw oedema and cotton pellet granuloma models in albino male rats. The paw volume was measured plethysmometrically at 0, 1, 2, 3, 4 and 5 h and diclofenac sodium was used as a standard drug. The alcohol extract (375 and 500 mg/kg) showed the maximum inhibition of oedema of 65.38% and 72.37% respectively, at the end of 3h with carrageenan-induced rat paw oedema. Using a chronic test, the extract exhibited a 40.03% and 45.32% reduction in granuloma weight [34].

Antihelmintic activity

For preliminary evaluation of antihelmintic activity test samples of the aqueous extract of stem was prepared at the concentration of 2.5, 5, 10, 20 mg/ml in Tween 20 (1%) solution diluted with normal saline and 6 worms of *Pheretima posthuma* of 8-10cm were placed in Petri dish containing 30 ml of above test solutions of extracts. Albendazole (2.5, 5, 10, 20 mg/ml) was used as reference standard and normal saline with Tween 20 (1%) is used as negative control [35, 36].

Analgesic activity

Kumar *et al.,* (2009) [37] reported the hydro alcoholic extract of the roots and leaves of *A. aspera* shows centrally acting analgesic activity in adult male albino rats using tail flick, hot plate and acetic acid induced writhing method for peripherally acting analgesic activity using aspirin as standard drug. The doses administered were 200 mg/kg and 400 mg/kg. The animal that administered with a dose of 400 mg/kg leaf extract has shown the maximum analgesic activity 66 reported that achyranthine a water-soluble alkaloid had a slight antipyretic activity in rats. The leaves and seeds of *A. aspera* showed analgesic activity [38].

Anti-arthritic

Anti-arthritic activity of Achyranthine from *A. aspera* has been reported [39]. Ethanolic plant extract has shown antiarthritic activity [41]. The plants efficacy in rheumatoid arthritis was also reported [40].

Wound healing activity

The plant has shown wound healing activity [42-43, 45]. There has been a report on comparative protein profile of granulation tissues of burn, diabetic and immunocompromised wounds treated with 5.0% (w/w) ointment of methanol extract of the plant [44].

Anti-dandruff activity

Methanolic leaf extract of *A. aspera* as a constituent of a polyherbal hair oil (PHO) showed anti-dandruff activity [46].

Neuropharmacological activity

Methanol extract of the plant was reported to have neuropharmacological (central nervous system depressant) activity [47]. The plant was screened *in vitro* for anti-hypertensive effect [48].

Anti snake venom activity

Anti snake venom activity of the plant has been reported experimentally supporting its widespread ethnic use against poisonous bite [49-51,52, 53].

Renal Disorders

Mineralization of urinary stone (calculi) like calcium oxalate, calcium carbonate and calcium phosphate were found to be inhibited by *A. aspera*. Methanolic extracts were found to prevent lead induced nephrotoxicity in albumin rats [54]. Efficacy of the roots of the plant was tested on calcium oxalate crystal nucleation and growth *in vitro* and on oxalate induced injury in NRK-52E (rat renal tubular epithelial) cells. As approach to anti-lithiasis, inhibitory effect of hydro-alcoholic extract of the plant on crystallization of calcium oxalate in synthetic urine was studied. [55]

Diuretic Activity

A saponin isolated from the seeds of *Achyranthus aspera* which shows significant diuretic effect in adult male albino rats. The optimum oral dose of saponin was 10mg/kg in rat increase in urine output which was comparable to 10mg/kg oral dose of acetazolamide [56].

Spermicidal Activity

Extracts from the roots of *Achyranthes aspera* and reported spermicidal activity in human and rat sperm. The hydroethanolic, n-hexane and chloroform extracts were found to be most effective for sperm immobilization, sperm viability, acrosome status, 5'-nucleotidase activity and nuclear chromatin decondensation Studied [57].

Antioxidant Activity

The plant has shown antioxidant activity in different investigations [58]. Antioxidant potential of the methanol extract of the leaves and roots of the plant was evaluated by using *in vitro* 1, 1-diphenyl-2-picrylhydrazyl (DPPH) scavenging assay [59]. Both extracts were assessed using two methods, DPPH radical scavenging activity, and superoxide scavenging activity. The plant exhibited good antioxidant effect by preventing the formation of free radicals in the two models studied.

The DPPH radical scavenging activity was performed according to the method of with few modifications [60]. The plant extracts were diluted in distilled water to make 10, 20, 40, 60, 80 and 100µg/ml dilutions. Two milliliters of each dilution were mixed with 1ml of DPPH solution (0.2Mm/ml in menthol) and mixed thoroughly. The mixture was incubated in dark at 20°C for 40min. Absorbance was measured at 517nm using UV Vis. Spectrophotometer with menthol as blank. Gallic acid was used as positive control. The percentage scavenging of DPPH by the extracts was calculated according to the following formula:

% DPPH Radical scavenging = [(Ac-At) ÷ Ac] ×100

Here,

Ac is the absorbance of the control (DPPH)

At is the absorbance of test sample

Phytochemical screening of the *A. aspera* presence of major phytochemicals in the methanol extract; carbohydrates, phenolic compounds, oil and fats, saponins, flavonoids, alkaloids and tannins, whereas, aqueous extract contained phenolic compounds, saponins, flavonoids and tannins as major phytochemicals. The presence of polysaccharides, ecdysterone, achyranthine, betaine (Alkaloids), vanillic acid, syringic acid, *p* coumaric acid (phenolic acids), saponin A, saponin B (saponins), protein and carbohydrates in *A. aspera*. Presence of phenolic compounds in the plant suggests the potential use of *A. aspera* as a source of antioxidant compound**s** [61].

Cancer Chemo preventive Activity

A. Chakraborty *et al*. (2002) reported that the methanolic extracts of leaves, alkaloid, nonalkaloid and saponin fractions shows cancer chemo preventive action on Epstein- Barr virus early antigen activation induced by tumor promoter 12-Otetradecanoylphorbol-13-acetate in Raji Cells. [62]

Broncho-protective activity

Goyal et al., (2007) reported that the ethanol extract of A. aspera shown broncho-protective effect in toluene diisocyanate (TDI) induced occupational asthma in Wistar rats. The total and differential leucocytes were counted in blood and bronchoalveolar (BAL) fluid. Liver homogenate was utilized for assessment of oxidative stress and lung histological examination was performed to investigate the inflammatory status of airway [63].

Antibacterial activity:

The various extracts of leaves and callus of the plant showed antimicrobial activity [64]. The ethanol and chloroform extract of seeds of *A. aspera* showed antibiotic activity against *Bacillus subtilis, E. coli and Pseudomonas aeruginosa* [65]. Alcoholic extract showed the presence of teriterpenoid saponin with dose dependent inhibitory activity against *Staphylococcus aureus* [66]. Ethanol extract of leaves and stem of plant inhibited *Bacillus subtilis* and *Staphylococcus* bacterial strains [67]. The seed grown on cattle dung heaps revealed antibacterial activity against bacterial strains of *B. subtilis, S. typhimurium* and *Pseudomonas cichori* [68]. Meera *et al.*, (1999) [69] reported the extract of the leaves was found to be active against the isolated bacteria *E. coli* and *S. citri*. The aqueous solution of the achyranthine as well as the entire plant showed antibacterial activity against *Staphylococcus aureus, B. typhosus* and *S. haemolyticus* [70]. Alcoholic and aqueous extract of the leaves showed antibacterial activity against *S. aureus* and *E. coli* [71]. The *in vivo* investigations of aqueous leaf extract shown antibacterial activity against *Proteus vulgaris*. The extract was inactive against *Klebsiella aerogenes, P. aeruginosa* and *E. coli* 8. In comparative study of herbal agents used for fumigation in relation to formalin, the plant reduced the microbial colony counts in air samples considerably [72]. Methanol leaf extract of *A. aspera* reported as potent inhibitor of Gram-positive *S. aureus* with a minimal inhibitory concentration of 5000 µlml-1 [73]. Prabhat *et al.*, (2005, 2010) [74,75] reported broad spectrum antibacterial activities of methanolic extract of *A. aspera* against *Staphylococcus aureus, Streptococcus mutans, S. salivarius, S. sanguis, Lactobacillus acidophilus, Bacillus subtilis,* and *E. coli*. Phytochemical analysis of plant showed the presence of biologically active constituents which exerted synergistic antimicrobial effect. Patil *et al.*, (2012) [76] reported *in vitro* antibacterial activity of dry stem extracts against dental caries causing microbes. Saravanan *et al*., (2008) [77] reported the solvent leaf extracts were tested for antibacterial activities against *E*. coli, *P. aeruginosa, P. vulgaris,* S. *aureus, Klebsiella* species.

4. Conclusion

Achyranthes aspera L. is commonly found as a weed on way side and at waste places throughout India. The plant is used in hypoglyceamic, as a diuretic, astringent and purgative, as an antidote to snake bite, in fractured bones, whooping cough, respiratory troubles, for asthma, spermicidal, antiallergic, cardiovascular, nephroprotective, cancer antiparasitic, hypoglycemic, analgesic, antibacterial, It is reported to contain alkaloids, flavonoids, saponins, steroids and terpenoids. The whole plant and its parts have been widely studied for its pharmacological activities and finds its position as a versatile plant having a wide spectrum of medicinal activities. The pharmacological experiments performed on the plant must be extended to the next level of clinical trial to generate novel drugs. This might prove helpful to use its immense therapeutic efficacy as a potent phytomedicine.

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